

ABSTRACT OF THE DISCLOSURE

[0067] A rigorous full waveform inversion of seismic data is presented that does not require any source information, therefore, eliminating potential errors involved in the physical and mathematical approximation of source input functions and their coupling to unrepeatable geological sites. A set of seismic trace data is collected in an input data set that is first Fourier transformed in its entirety into the frequency domain. A normalized wavefield is obtained for each trace of the input data set in the frequency domain. Normalization is done with respect to the frequency response of a reference trace selected from the set of seismic trace data. The normalized wavefield is source independent, complex and dimensionless. The normalized wavefield is shown to be uniquely defined as the normalized impulse response, provided that a certain condition is met for the source. This property allows construction of the inversion algorithm disclosed herein, without any source or source coupling information. The algorithm minimizes the error between data normalized wavefield and the model normalized wavefield. The methodology is applicable to any 3-D seismic problem, and damping may be easily included in the process. A proof of principle of the invention is demonstrated using a simple 2-D scalar problem.